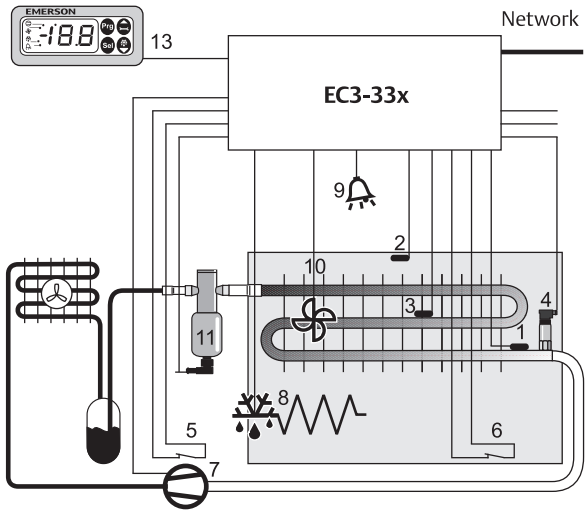
EC3-331 Coldroom Controller and ECD-001 Display Unit

Operating Instructions

GB

Note: This document contains short form instructions for experienced users. Use last column in List of Parameters to document your individual settlings. More detailed information can be found in the User Manual.

The **EC3-331** is a dedicated controller for refrigerated coldrooms with superheat control and a driver for an Alco Controls Electrical Control Valve EX4...EX8. In addition the **EC3-331** controls air temperature and manages defrost and fan(s).



A PT4 pressure transmitter (4) and an ECN-Pxx pipe temperature sensor (1) measure saturated suction gas pressure and suction gas temperature at the evaporator outlet and feed the signals into the superheat control loop. The superheat controller output modulates the opening of the EX4…EX8 Electrical Control Valve (11) thus optimising the refrigerant mass flow through the evaporator. The ECN-Sxx air temperature sensor (2) measures air-in temperature at the evaporator and feeds a signal into the air temperature thermostat. The ECN-Fxx fin sensor (3) is used for defrost termination. Digital input (5) should be connected to the serial control loop of a compressor (where applicable) and digital input (6) should be connected to the coldroom door contact. The controller has 4 relay outputs to control the compressor (7), defrost heater (8) evaporator fan (10) and an external alarm device (9). Please consult the technical data (right) for input and output ratings.

The EC3-331 features an integral backup battery to close the electrical control valve in case of power loss. Due to the positive shut-off characteristics of the EX4…EX8 Electrical Control Valves, a liquid line solenoid valve is not needed to prevent flooding of the compressor.

The optional ECD-001 Display Unit (13) can be connected to the EC3-331 for local display of control parameters and for controller setup without the use of a PC. Because the EC3-331 is fully functional without display unit the ECD-001 may be removed at any time.

⚠ Safety instructions:

- **Read installation instructions thoroughly. Failure to comply can result in device failure, system damage or personal injury.**
- **The product is intended for use by persons having the appropriate knowledge and skills.**
- **Ensure electrical ratings per technical data are not exceeded.**
- **Disconnect all voltages from system before installation.**
- **Keep temperatures within nominal limits.**
- **Comply with local electrical regulations when wiring**
- **The EC3 series contains a lead, acid gel rechargeable battery. The battery must NOT be disposed of with other commercial waste. Instead, it is the users responsibility to pass it to a designated collection point for the safe recycling of batteries (harmonised directive 98/101/EEC). For further information, contact your local environmental recycling centre.**

Technical Data

EC3 Series Controller

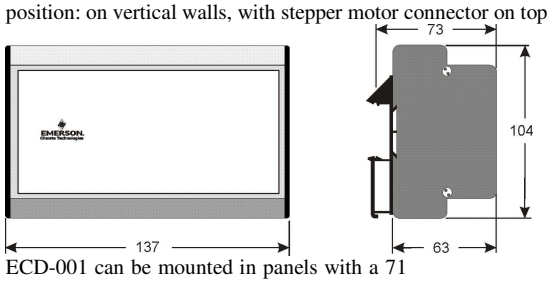
Power supply	24VAC ±10%; 50/60Hz; Class II 6.3mm spade earth connector
Power consumption	25VA max. including EX4 … EX7 28VA max. including EX8
Communication	LonWorks® Interface, FTT10, RJ45 connector
Plug-in connector size	Removable screw terminals wire size 0.14 … 1.5mm^2
Ambient temperature range	0 … 60°C 1 … 25°C (for best battery life time) > 35°C battery life time < 2 years
⚠ In order to provide system protection in the event of power loss, it is recommended to change the battery annually.	
Humidity	0…80% r.h. non condensing
Protection class	IP20
Pressure transmitter input	24VDC, 4...20mA
4-20 mA analog output Deviation from input signal	For connection to any 3rd party controller with 12/24VDC power supply and appropriate burden ±8% max
Analog output	24VDC, 4...20mA
Digital Inputs	24VAC/DC
Output relays (4) Alarm, Comp Heater, Fan	Inductive (AC15) 250V/2A SPDT contacts, AgNi, resistive (AC1) 250V/8A SPST contacts, AgNi, resistive (AC1) 250V/6A
⚠ If the alarm relay is not utilized, the user must ensure appropriate safety precautions are in place to protect the system against damage caused by a power failure.	
Stepper motor output	For EX4…EX8 Electrical Control Valves

ECD-001 Display Unit

Power Supply	From EC3-331 via connecting cable
Display	2½-digit red LED with decimal point switchable between °C and °F
LED indicators	Compressor, Fan, Defrost, Alarm, IR status
Temp & Humidity	Identical to EC3-331 specifications above
Protection class	IP65 (front protection with gasket)
Connecting cable	ECC-N10 (1,0m) or CAT5 cable with RJ45 connectors

Mounting

The EC3-331 is designed to be mounted onto a standard DIN rail. Mounting position: on vertical walls, with stepper motor connector on top side only.



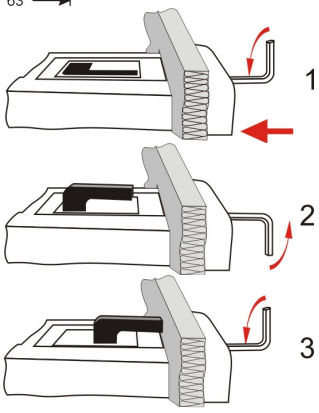
ECD-001 can be mounted in panels with a 71 x 29 mm cutout. See dim. drawing below for space requirements including rear connectors.

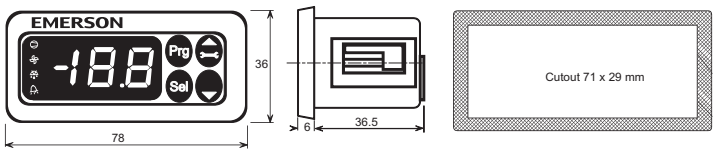
Push controller into panel cutout.(1)

Make sure that mounting lugs are flush with outside of controller housing. Insert Allen key into front panel holes and turn clockwise. Mounting lugs will turn and gradually move towards panel (2)

Turn Allen key until mounting lug barely touches panel. Then move other mounting lug to the same position (3).

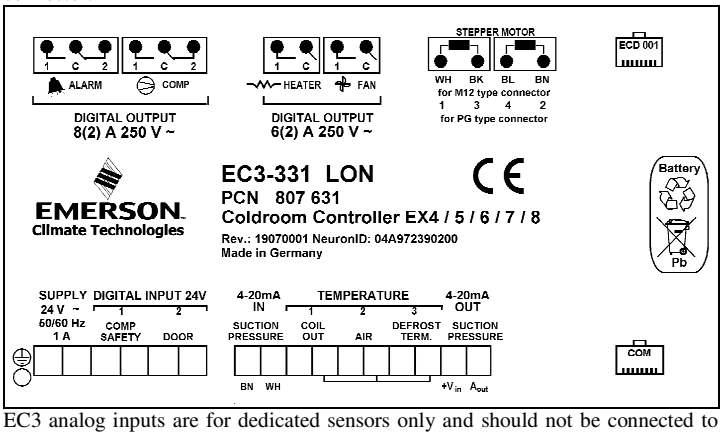
Tighten both sides very carefully until controller is secured. Do not over tighten as mounting lugs will break easily.





Electrical Installation

Refer to the electrical wiring diagram (below) for electrical connections. A copy of this diagram is labeled on the controller. Use connection wires/cables suitable for 90°C operation (EN 60730-1). Ground the metal housing with a 6.3mm spade connector.



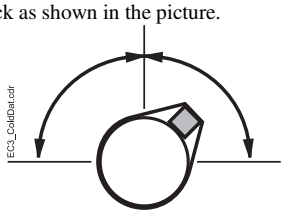
EC3 analog inputs are for dedicated sensors only and should not be connected to any other devices. Digital inputs should only be connected to 24VAC/DC. Connecting any EC3 inputs to mains voltage will permanently damage the EC3.

Important: Keep controller and sensor wiring well separated from mains wiring. Minimum recommended distance 30mm..

Warning: Use a class II category transformer for 24VAC power supply (EN 61558). Do not ground the 24VAC lines. We recommend to use one transformer per EC3 controller and to use separate transformers for 3rd party controllers, to avoid possible interference or grounding problems in the power supply. Connecting any EC3 inputs to mains voltage will permanently damage the EC3.

Recommended Sensor Positions for Cold Room Applications:

ECN-Pxx coil-out temperature sensor (1): Position directly after the evaporator on the common suction line as shown below. Insure proper thermal contact by using a metallic pipe clamp or temperature resistant plastic straps. Do not use standard plastic tie wraps (as used for electrical wiring) as they may become loose over time, which could result in faulty temperature measurements and poor superheat control performance. It is recommended to insulate the coil-out temperature sensor with ARMAFLEX™ or equivalent. The recommended position of the pipe sensors is between 9 and 3 o'clock as shown in the picture.



PT4-07M suction pressure transmitter (4): Position on the common suction line close to coil-out temperature sensor (1)

ECN-Sxx air temperature sensor (2): Should be mounted on spacers in the middle of the air duct so that there is airflow around and positioned on the inlet of the evaporator as high as possible close to the ceiling.

ECN-Fxx fin temperature sensor (3): Position on the evaporator, asymmetric closer to the expansion valve.

Setup and Parameter Modification Using the Keypad of the ECD-001

For convenience, an infrared receiver for the optional **IR remote control unit** is build-in, enabling quick and easy modification of the system parameters when a computer interface is not available.

Alternatively, the parameters can be accessed via the 4-button keypad. The configuration parameters are protected by a numerical password. The default password is "12". To select the parameter configuration:

- Press the **PRG** button for more than 5 seconds, a flashing "0" is displayed
- Press ▲ or ▼ until the password is displayed (default = "12"), if password was changed select the new password
- Press **SEL** to confirm password

The first modifiable parameter code is displayed (/1).

To modify parameters see Parameters modification below.

Parameter Modification: Procedure

- Press ▲ or ▼ to show the code of the parameter that has to be changed;
- Press **SEL** to display the selected parameter value;
- Press ▲ or ▼ to increase or decrease the value;
- Press **SEL** to temporarily confirm the new value and display its code;
- Repeat the procedure from the beginning "*press* ▲ or ▼ *to show...*"

To exit and save the new settings:

- Press **PRG** to confirm the new values and exit the parameters modification procedure.

To exit without modifying any parameter:

- Do not press any button for at least 60 seconds (TIME OUT).
- Press "**ESC**" on IR remote control.

Defrost Activation:

A defrost cycle can be activated locally from the keypad:

- Press the ▼ button for more than 5 seconds, a flashing "0" is displayed
- Press ▲ or ▼ until the password is displayed (default = "12"), if password was changed, select the new password
- Press **SEL** to confirm password

The defrost cycle is activated.

Special Functions:

The Clear Alarm function has been replaced by the Special Functions mode. The Special Functions can be activated by:

- Press ▲ and ▼ together for more than 5 seconds, a flashing "0" is displayed.
- Press ▲ or ▼ until the password is displayed (default = "12"). If password was changed, select the new password.
- Press **SEL** to confirm password
- A "0" is displayed and the Special Function mode is activated.
- Press ▲ or ▼ to select the function. The number of special functions is dynamic and controller dependent. See list below.
- Press **SEL** to activate the function without leaving the special function mode.
- Press **PRG** to activate the function and leave the special function mode.

Most of the Special Functions work in a toggle mode, the first call activates the function, and the second call deactivates the function.

The indication of the function can only be displayed after exiting the special function mode.

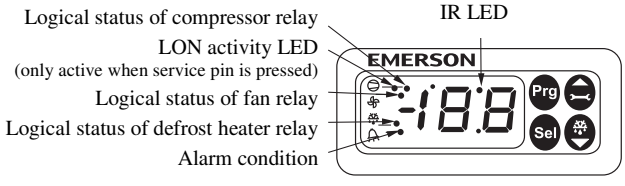
- 0: Display test function
- 1: Clear alarm messages
- 2: Cleaning mode. The cleaning mode is effectively a manual defrost with the option of the fans on/off. The cleaning mode should not be used in order to isolate the application for maintenance purposes.
- 3: Fans only
- 4: Set the electronic control valve to 100% open
- 5: Resets all parameters to the factory default setting. The controller will indicate "oF" during the reset and the valve will close.

Display of Data:

The data to be shown on the display can be selected by the user. In case of an alarm, the alarm code is displayed alternately with the selected data. The user can inhibit the alarm code. Press the **SEL** button to scroll through all possible displayable data.

The display will show for one second the numerical identifier of the data and then the selected data. After two minutes the display will return to the by parameter /1 selected data.

It is possible to temporarily display the values of the different sensors. This is a useful feature when initially setting-up the system without the aid of the WebPages. Press the **SEL** sequentially. The value displayed on the screen corresponds to the number corresponding to the /1 parameter. Action only valid when parameter H2 = 3.



List of Parameters

/	DISPLAY PARAMETERS	Min	Max	Unit	Def.	Custom
/1	Value to show 0 = Thermostat control temperature with Temp. alignment /C 1 = Defrost termination temperature °C 2 = Coil-in temperature °C calculated from the pressure 3 = Coil-out temperature °C 4 = Calculated superheat °K 5 = Valve opening in % 6 = Displays defrost status	0	6	-	0	
/2	Alarm suppression 0 = off, 1 = on	0	1	-	0	
/5	Temperature Unit 0 = °C, 1 = °F	0	1	-	0	
/6	Decimal point 0 = yes, 1 = no	0	1	-	0	
/7	ECD display during defrost 0 = dF (= defrost mode); 1 = dF + defrost termination temp. 2 = dF + control temperature	0	2	-	0	
/C	Temperature alignment for /1=0	-20.0	20.0	K	0.0	
A	**ALARM PARAMETERS**					
A1	Low temp alarm delay	0	180	min	5	
A2	High temp alarm delay	0	180	min	5	
A3	Alarm delay after defrost	0	180	min	10	
Ad	Door alarm delay	0	180	min	2	
AH	High temp alarm limit	AL	70	°C / K	40	
AL	Low temp alarm limit	-55	AH	°C / K	-50	
At	Alarm limit type 0=absolute temperatures °C; 1= relative temperatures K to setpoint	0	1	-	0	
r	**THERMOSTAT PARAMETERS**					
r0	Door contact function (see page 4)	0	15	-	6	
r1	Min. setpoint	-50	r2	°C	-50	
r2	Setpoint max.	r1	60	°C	40	
r3	Day/night control 0 = off, 1 = on	0	1	-	1	
r4	Thermostat mode 0 = off, no thermostat function, continues cooling air in sensor monitoring off, no temp. alarms generated 1 = cooling, deadband control cut in = set-point + difference / cut out = set-point 2 = cooling, modulating thermostat cut in = set-point / cut out = set-point – difference /2 3 = heating, deadband control cut in = set-point – difference / cut out = set-point 4 = on, external control using nvi Valve via SNMP. Air sensor monitoring off. Temperature alarms will be generated	0	4	-	1	
r6	Setpoint night	r1	r2	°C	4.0	
r7	Differential night	0.1	20.0	K	2.0	
rd	Differential day	0.1	20.0	K	2.0	
St	Setpoint day	r1	r2	°C	2.0	
d	**DEFROST PARAMETERS**					
d0	Defrost mode 0 = natural defrost, defrost heater not activated pulsed defrost not possible 1 = forced defrost, defrost heater activated, pulsed defrost possible 2 = forced defrost, defrost heater activated, pulsed defrost possible, defrost termination using nviStartUp	0	2	-	1	
d1	Termination by: 0 = termination by temperature, termination by time will generate an alarm 1 = termination by time, termination by temperature will generate an alarm 2 = first, what ever comes first time or temperature, no alarm 3 = last, by time and temperature, no alarm Caution: can generate indefinite defrost periods	0	3	-	0	
d3	Pulsed defrost 0 = off, no pulsed defrost, heaters switched off at defrost termination temperature dt or max. time dP whatever is selected 1 = on, pulsed defrost, dd and dH in use, heaters are switched off at dH and switched on again at dH – dd	0	1	-	0	
d4	Defrost at startup 0 = no, 1 = yes	0	1	-	0	
d5	Delay power up defrost	0	180	min	0	
d6	Pump down delay Compressor will run during pump down delay while valve is closed	0	180	sec	0	
d7	Drain delay	0	15	min	2	
d8	Injection delay Valve is open during injection delay while compressor is not running	0	180	sec	0	

		Min	Max	Unit	Def.	Custom
dd	Pulsed defrost differential	1	20	K	2	
dH	Pulsed defrost setpoint	-40	dt	°C	5	
dt	Defrost termination temperature	-40	90	°C	8	
dP	Max. defrost duration	0	180	min	30	
dI	Defrost interval	0	192	h	8	
du	Start up delay after synch	0	180	min	30	
F	**FAN PARAMETERS**					
F1	Fan startup after defrost by: 0 = on 1 = delayed by time Fd, error on temperature 2 = by temperature Ft, error on time 3 = first, whatever comes first time or temperature, no alarm 4 = last, time and temperature must come, no alarm	0	4	-	0	
F2	Fan during no cooling 0 = on; 1 = off; 2 = delayed by F4; 3 = off, when door open	0	3	-	0	
F3	Fan during defrost 0 = on, 1 = off	0	1	-	0	
F4	Stop delay time	0	30	min	0	
F5	Fan during cleaning 0 = off, 1 = on	0	1	-	0	
Fd	Fan delay after defrost	0	30	min	0	
Ft	On temp after defrost	- 40	+ 40	°C	0	
C	**COMPRESSOR PARAMETERS**					
C0	Delay first start	0	15	min	0	
C1	Cycle time	0	15	min	0	
C2	Min. stop time it	0	15	min	0	
C3	Min. run time	0	15	min	0	
u	**SUPERHEAT PARAMETERS**					
u0	Refrigerant 0 = R22 1 = R134a 2 = R507 3 = R404A 4 = R407C 5 = R410A 6 = R124 7 = R744A	0	7	-	3	
u1	Correction glide / dp Glide = positive values Pressure drop = negative values	-20.0	20.0	K	0.0	
u2	MOP control 0 = MOP off, 1 = MOP on	0	1	-	0	
u3	MOP temperature	-40	40	°C	0	
u4	Superheat mode 0 = off, 1 = fixed superheat, 2 = adaptive superheat 3 = fixed superheat slow, 4 = adaptive superheat slow (Rev >=25)	0	4	-	1	
u5	Superheat init setpoint	u6	u7	K	6	
u6	Superheat setpoint min	3	u7	K	3	
u7	Superheat setpoint max	u6	20	K	15	
u9	Start opening delay (Rev >= 23)	0	60	10sec	1	
uu	Start opening	10	100	%	30	
ut	Valve type 0 = EX4 / EX5, 1 = EX6, 2 = EX7, 3 = EX8	0	3	-	0	
uF	Valve scaling factor uF = 100%, max. valve opening =100%, ECD display =100% uF = 50%, max. valve opening = 50%, ECD display =100%	20	100	%	100	
P	**ANALOG SENSOR PARAMETERS**					
P1	Pressure sensor type selection 0 = PT4-07M, 1 = PT4-18M, 2 = PT4-30M	0	2	-	0	
I	**LOGIC PARAMETERS**					
I0	Logic for compressor safety loop input 0 = 24V input voltage means failure; 1 = 0V input voltage means failure	0	1	-	0	
I1	Logic for door contact input 0 = 24V means door open; 1 = 0V means door open	0	1	-	0	
o0	Logic for alarm relays activated 0 = positive logic; 1 = negative logic	0	1	-	1	
o1	Logic for compressor relays activated 0 = positive logic; 1 = negative logic	0	1	-	0	
o2	Logic for heater relays activated 0 = positive logic; 1 = negative logic	0	1	-	0	
o3	Logic for fan relays activated 0 = positive logic; 1 = negative logic	0	1	-	0	
H	**OTHER PARAMETERS**					
H2	Display access 0 = all disabled (Caution: access to controller only via the LON network) 1 = Keyboard enabled; 2 = IR remote control enabled 3 = Keyboard and IR remote control enabled	0	3	-	3	
H3	IR access code	0	199	-	0	
H5	Password	0	199	-	12	

Remarks: r0 Door contact function

r0	Cooling	Temp. alarm	Function after delay time Ad
0 = 8	on	on	
1 = 9	off	on	
2 = 10	on	off	
3 = 11	off	off	
4 = 12	on	on	door alarm
5	off	on	door alarm
6 = 14	on	off	door alarm and temperature alarm on
7	off	off	door alarm and temperature alarm on
13	off	on	door alarm and cooling on
15	off	off	door alarm and cooling on and temperature alarm on

Alarm Codes

E0 **Pressure transmitter alarm**

E1 **Coil out sensor alarm**

E2 **Air sensor alarm**

E3 **Fin sensor alarm**
No sensor connected or the sensor and/or the sensor cable is broken or short-circuited.

Er **Data error display - out of range**
Data send to the display is out of range.

Ab **Battery health failure**
Battery potentially does not have enough charge to close valve in an emergency. Only reset by replacing battery (Replacement kit: 807 790).

⚠ The use of the relay is essential to protect the system in case of power failure if the communications interface or the ECD-002 are not utilized.

AC **Alarm status of the compressor serial loop feedback**
External compressor is active. Serial safety loop is open circuit

Ad **Door open alarm**

AE **Thermostat emergency operation**
Air sensor failure, system is in continuous cooling mode

AF **Valve Status**
Valve closed due to compressor safety loop active

AH **High temperature alarm**

AL **Low temperature alarm**

AM **ECV connection error**
Check connections to EX4…8 Electrical Control Valve

Ao **Superheat, emergency operation**
Sensor(s) failure

Au **Valve open 100% for more than 10 minutes**

dt **Forced defrost termination (time or temperature)**

Ft **Forced fan startup (time or temperature)**

Messages

--- **No data to display**
The display will show an "---" at node start up and when no data is send to the display.

In **Reset to default values activated**
The display will show an "In" when the factory default configuration data set is initialized.

Id **Wink request received**
The display will show a flashing "Id" when the wink request was received. The flashing "Id" will be shown on the display until the service button will be pressed, or a 30 min delay timer will expire or a second wink request is received.

OF **Node is offline**
The node is offline and no application is running. This is the result of a network management command and will happen for example during node installation.

dS **Defrost standby**

dP **Pump down**

df **Defrost cycle**

dd **Defrost drain delay**

dI **Defrost injection delay**

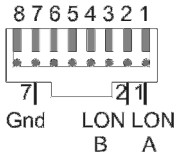
du **Defrost start-up delay**

Cn **Cleaning**

CL **Alarms are cleared**

Visualising Data: LON Monitoring Server

The **EC3-331** has a LON communication interface enabling the controller to be directly connected to a Monitoring Server. Front view of RJ45 connector:



Neuron ID / Service PIN:

The service pin is available on the ECD display. It is used to identify the controller in a LON network.

Press the button for approx. 1 sec. to send the Neuron ID. The LED in the left upper corner will indicate the transmission of the Neuron ID.
The default settings may be modified remotely from the EMS Monitoring Server via the LON network. Consult the EMS user manual for more information.
It is also possible to display live graphical data on the server or to log data containing the control temperature at defined intervals.

Emerson Electric GmbH & Co OHG is not to be held responsible for erroneous literature regarding capacities, dimensions, applications, etc. stated herein. Products, specifications and data in this literature are subject to change without notice. The information given herein is based on technical data and tests which EMERSON believes to be reliable and which are in compliance with technical knowledge of today. It is intended only for use by persons having the appropriate technical knowledge and skills, at their own discretion and risk. Since conditions of use are outside of EMERSON's control we cannot assume any liability for results obtained or damages occurred due to improper application.
This document replaces all former versions